Naval War College Review

Volume 4
Number 2 *February*

Article 1

1951

February 1951 Full Issue

The U.S. Naval War College

U.S. NAVAL WAR COLLEGE
INFORMATION SERVICE FOR OFFICERS

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Vol. III No. 6 February, 1951

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INFORMATION SERVICE FOR OFFICERS

Issued Monthly By
The Department of Correspondence Courses
U. S. Naval War College
Newport, R. I.

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FOREWORD

Information Service for Officers was established by the Chief of Naval Personnel in 1948. It contains lectures and articles of professional interest to officers of the naval service.

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TACTICAL AIR OPERATIONS

A Lecture delivered by
Major General W. R. Wolfinbarger, U. S. A. F.
at the Naval War College
10 October 1950

Admiral Cooley, members of the Staff, and students of the Naval War College:

It is an honor and a privilege to be permitted to address you today on a subject which is related to one of the three major missions of the United States Air Force. Our Chief of Staff, General Vandenburg, has made the following statement before the Committee on Armed Services of the House of Representatives in Washington:

"In the light of world conditions, in case of aggression against the United States, the major tasks to be undertaken by the Air Force in the defense of our country are clear:

First: The delivery of an immediate and powerful strategic air offensive against the basic sources of our enemy's war making capacity.

Second: The defense of the United States and our essential bases against attack by air.

Third: Tactical support of the Army and Navy in exploitation of the opportunity presented through successful prosecution of the first two tasks."

This last mission is obviously an extremely important one and is one to which the Air Force is devoting an increasing amount

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of attention. Strategic Bombing and Air Defense may catch the public fancy and warrant the bulk of the newspaper publicity, but this in no way indicates that the problems of Tactical Air Support are being neglected.

In treating this subject of Tactical Air Support I shall endeavor to confine my remarks to those aspects of the Tactical Air problem which are appropriate to you gentlemen who are at this school preparing yourselves for staff positions in higher headquarters and as senior commanders.

My objective during this lecture is to tell you as much as I can, in the short time available, regarding the problem of assuring that the surface forces receive the best possible assistance from the Air Force during combat operations.

I shall discuss principles involved, the methods of achieving the necessary coordination between the surface forces and the air forces, the capabilities and limitations of Tactical Air Power which I believe must be recognized by key staff officers and commanders, and finally, some of the trends in this type of operation that may be affected by new development of weapons.

The measure of success we will achieve, when and if this type of operation becomes necessary, will depend directly upon the proper definition and application of these principles, the degree of coordination achieved and a sound knowledge of the optimum usage of the air weapons to be employed.

Before proceeding to the main points of discussion, I shall limit and define the subject a bit more.

I shall here discuss primarily those elements of tactical air power which are mainly engaged in making offensive strikes

against enemy targets, and thereby of course assist the surface forces in the accomplishment of their mission.

There are however other functions of tactical air which will not be dealt with in detail during this hour, but which are equally important; and it is vital that you bear these functions in mind whenever you are thinking in terms of Tactical Air Support or are engaged in discussions on the subject. Tactical Air Support includes: maintaining air superiority in the area of operations; Air Defense of vital installations in our assigned area of responsibility; tactical reconnaissance, which includes weather, visual and day and night photographic reconnaissance; troop carrying of airborne units and their equipment; air resupply activities and evacuation of casualties; and air courier and messenger service. These functions, which are absolutely vital to the success of the surface forces, are usually completely ignored by the arm chair experts, and the people who think that when they have mastered the technique of furnishing close support to a front line battalion or regiment, that they have learned all there is to know about Tactical Air. In drawing conclusions on this subject, always remember that the functions of a Tactical Air Force include many responsibilities in addition to the requirement for close support of the ground force.

Before becoming involved in the details of doctrine and employment of air support, it might be well to take a quick glance at the over-all concept pertaining to operations in this field. In other words, we should consider the conditions under which this air-ground or Air-Navy-Army team might operate in future war.

As an example, there are many who believe that it will never again be necessary to launch a full scale amphibious invasion with land, sea and air forces assaulting the enemy on a hostile shore. Others profess to believe that such operations will be im-

possible in the future. Others say that practically all previous concepts have been swept away by the atomic age. I am sure we all realize that past wars will never be re-fought and that circumstances and weapons are constantly changing. However, be that as it may, we believe that as long as our military establishment consists of three major components, land, sea and air, it is reasonable to assume, that in the event of war in the immediate future, major participation of all three services will be required. Furthermore, in any mission which will require a two or three-service task force, it is conceived that the tasks of supporting air would, in general, be the same as they were at the end of World War II.

These then are the offensive tasks: we must have the capability of air combat to maintain the necessary degree of air superiority in the area of operations; we must have the capability of striking targets whose destruction will prevent hostile supplies and reserves from reaching the area of action of our ground or sea forces; and we must have the capability of striking targets which are actually resisting the advance of our supported force.

The means of achieving proper allocation of the tactical air effort and of securing the necessary coordination between the services, as developed during the last war, were reasonably successful. Thus it would appear that the broad principles which governed the employment of tactical air support at the end of World War II are still valid for the immediate future.

Newer and better weapons are being developed, aircraft speeds are increasing, and tactics and techniques must be progressively modified at fairly frequent intervals. Sound principles however are only seldom outmoded.

There are five fundamental principles covering the Tactical

employment of Air Power which I believe are still valid and which deserve further comment here. These are:

1. There must be centralized control of tactical Air Units which are supporting surface forces.

2. The effort of the Tactical Air Force and the surface forces must be integrated.

3. The gaining and maintaining of air superiority in the combat area and in areas of projected operations of the surface forces is vital in order to assure success of a major ground or amphibious campaign.

4. Interdiction of the battle area is the most profitable manner in which to employ offensive tactical air units against ground and naval targets in the support of armies and amphibious forces.

5. In accordance with the coordinated plan of operation, striking elements of the Tactical Air Forces must attack and destroy ground or naval targets in the immediate battle area.

The first two of these principles, which I have set forth, deal with organization, and the relationship between the operating Army, Navy and Air Force Headquarters. The other three principles bear directly on employment or the manner in which the tactical air striking units are utilized. All five together comprise the basis upon which sound employment of tactical air power is founded.

Having taken a brief glance at the items set forth on the chart, let us examine each one a bit more in detail.

First is the matter of centralized control. Centralized control is, of course, a basic military principle for the conduct of all military

operations. This does not mean that one man controls the detailed activities of every individual in a Tactical Air Force. It does mean, however, that the organization and command structure must exist so that, at any given moment, the air commander at any echelon of command may take advantage of the inherent flexibility and mobility of the air arm in order to divert air strikes to critical targets. He must be able to concentrate the air power at his disposal on objectives which require the application of the principle of mass. Through centralized control, the preponderance—or even all—of the air effort may be rapidly shifted in accordance with the changing requirements of a fast moving tactical situation.

The second principle, dealing with integration of effort, also affects the command and staff organization of the air and army headquarters or the components of a joint force, and the relationship of the commanders at various echelons. You will notice that I have said that the *effort* is integrated and not that the *forces* are integrated. The forces must form a team the higher commanders of which coordinate their efforts in order to attain a common objective which is the rapid and effective defeat of the hostile force. To achieve maximum effectiveness, each component of these coordinated forces must operate under its own commander. The scheme of employment of the air-surface team must be a coordinated action from the inception of the planning for the operation to its completion. I will discuss later how this coordination is effected.

The next three principles of sound employment of tactical air power bear directly on the manner in which the air striking units are utilized. Number three is that the gaining, and maintaining, of general air superiority, or air superiority in the area of combat and the areas of projected operations of the surface forces, is vital in order to assure success of any major ground or amphibious campaign. I do not believe that it will be necessary to develop this portion of the doctrine any further before this audience. Many of

you personally served in units which were helping to develop and prove the validity of this principle early in World War II. Throughout the war this principle was never questioned. Each successive campaign, in every theater, reaffirmed its validity.

The fourth basic principle, which we use as a guide in conducting offensive air support operations, may be stated as follows: The interdiction of the battle area is the most profitable manner in which to use offensive tactical air units against ground and naval targets in the support of armies and amphibious forces. It is axiomatic that the severance of the enemy's lines of communication compromises his ability to sustain, supply, deploy and reinforce his forces. An enemy with this reduced capacity is certainly a less formidable foe to oppose our supported units. Furthermore, enemy men or equipment, destroyed before gaining contact with our own forces, show the greatest net profit when balanced against the cost of our offensive operations.

In conducting these attacks on lines of communication, and here we are using the term in its broadest sense, the inherent characteristics of the airplane permit the crew to seek out, if need be, and successfully attack directly, troop concentrations, supply points, railroad movements, troop and supply ships, harbors, docks, headquarters and other facilities.

Troops in bivouac or on the move are always more vulnerable than when deployed in combat. Supplies being moved on land or on the sea, or assembled at storage or supply depots, are more concentrated than when broken down for distribution or issue. Vulnerable points, such as bridges, viaducts, choke points, harbors and docks, are easily identified from the air either visually or by electronic devices. These factors result in a greater percentage of aircraft finding and advantageously attacking interdiction targets than can be expected against deployed or dispersed targets.

The fifth and last basic principle dictates that, in accordance with the coordinated plan of operation, the striking elements of the tactical air force attack hostile ground or naval targets in the immediate battle area. Since this type of attack is in close proximity to our friendly forces, the tactical air force must exercise close direction and control, and the maximum of coordination with other friendly forces must be achieved.

Targets deployed in the battle area are usually not concentrated and are therefore less vulnerable than targets in the interdiction area. Troops are invariably dug-in, ground targets are protected by the maximum of camouflage and concealment. Consequently, these targets are more difficult to pick up and identify from the air. The probability is less that a given bomb, bullet or rocket will do as much damage here as the same missile would if fired on an interdiction target.

It goes without saying, that air crews must be carefully trained in identification procedures. Control personnel on the ground, and Army and Navy combat personnel, must likewise be carefully schooled in marking, identification, and follow-up procedures. Both Air Force and surface force commanders must never be permitted to forget the importance of the coordinated attack. Battle experience has amply demonstrated that the greatest benefits are gained if air attacks are immediately followed by assaulting troops. The most remunerative air support targets on the battlefield are those which are moving in a counter-attack, a shift in deployment, or in a withdrawal.

We could sum up the principles I have discussed in one sentence as follows: An air commander who has centralized control of offensive tactical air power, and whose efforts have been integrated with those of the ground or amphibious force commander, may, as the situation dictates, allocate or direct the mass of his of-

fensive resources to counter air operations, interdiction targets, and/or direct participation in the surface battle area.

I have discoursed at some length about principles and I must follow this up by reminding you that while principles are extremely important, they are still only principles, and they have been created to serve, and not to function as masters. It is sometimes easy to become a slave of operating doctrine and principle, and every principle must be re-examined each time it is employed.

The highest degree of coordination between Air Forces and Ground or Naval Forces in a theater or area of operations can only be achieved through the establishment of a sound command relationship between the appropriate forces, and by the exercise of close joint planning.

First let us consider organization. Normally, there will be a theater or task force commander whose command will be either unified or combined in nature. In this paper I will consider only the unified command which is composed only of the armed services of one country. In this case, the Theater Commanders staff is joint and is composed of appropriate representation from each of the three services. The forces within the theater are composed of Army, Navy, and Air Force components. If the operations in the Theater are of sufficient magnitude, the air component may consist of a Strategic Air Command, a Tactical Air Command, and appropriate supporting air commands. However, I believe that normally the strategic air forces would not be allocated to theater commanders, but would be retained under control of the Joint Chiefs of Staff. Therefore in a normal situation it is entirely possible that all the combat Air Forces operating under the Air Component commander might be in one or more Tactical Air Commands. The subordinate commands of the Air Force components of the theater forces would then be The Tactical Air Command and appropriate supporting com-

mands. And, in fact, the Tactical Air Command might be designated as the Air Force component of the Theater Forces.

The Tactical Air Command would be composed of an appropriate number of Tactical Air Forces, the Tactical Bomber Force, a Troop Carrier Force if required, a Tactical Reconnaissance Wing, and necessary service units. The corresponding levels of command between the Air Force and the Army are: THE ARMY GROUP—TACTICAL AIR COMMAND and THE FIELD ARM—TACTICAL AIR FORCE.

The Theater Commander allocates the force to be employed in the air-ground campaign to the Army Group and the Tactical Air Command, if necessary, through the respective theater component commanders. The Theater Commander establishes overall directives and priorities of operations for the guidance of the Army and Tactical Air Commanders. The Tactical Air Command is organized to support an Army Group and has assigned to it an appropriate number of Tactical Air Forces each of which is organized to support a Field Army. This type of organization of theater forces provides for parallel levels of command which work together to achieve the lateral coordination necessary for the successful accomplishment of the common mission.

In an area which may be remote from a theater, or for special tasks which may include the employment of Army, Navy and Air Forces, Joint Task Forces may be organized. The components of a Joint Task Force may consist of appropriate table of organization units such as the Field Army and a Tactical Air Force or component task force. Either arrangement permits the same lateral coordination between headquarters that exists in the theater organization.

This leads us to a discussion of command relationships between the forces.

In the examples which I have given, you will always find in every operation area, a common superior commander placed above the two or three military component commanders. This common commander issues a single directive to the air, naval, and/or ground component commanders who are then jointly responsible for the proper integration of their respective efforts to insure that the coordinated action achieved is in the furtherance of the common objective. Here then, parallel levels of command cooperate in planning and executing their operations. Yet the integrity of the chain of command in each component is preserved.

In air-ground operations, joint planning and command decisions are normally limited to the ARMY GROUP—TACTICAL AIR COMMAND and the FIELD ARMY—TACTICAL AIR FORCE, levels. Should there be a difference of opinion between any two commanders, the matter is referred to the next higher echelon of the air ground commands. For those matters which cannot be jointly resolved, the Theater or Joint Task Force Commander is the final and positive authority.

And now, I wish to comment on planning, which I consider *one,* or perhaps even *the* most important element necessary for the successful accomplishment of Air Support. For any coordinated effort, it is vital that planning be conducted on a joint basis, from the beginning. It must be carried through on a joint basis and be properly and jointly blended into the operational phase.

In the air-ground operations, joint planning is carried on at parallel levels of command down to, and including the ARMY-

TACTICAL AIR FORCE level which is the lowest echelon which plans and conducts independent operations.

At each level the corresponding headquarters are always located as close to each other as is practicable and at the FIELD ARMY—TACTICAL AIR FORCE level it is axiomatic that the headquarters be located literally side by side. The Air and Ground Commanders and their corresponding staff personnel are then readily able to exchange information, formulate plans, and discuss problems of joint interest. Even perfect communications, between widely separated headquarters, cannot substitute for the frequent personal contact between commanders and staffs in closely adjacent headquarters.

Joint planning should begin with the inception of the idea for the operation. The first phases are accomplished jointly in the theater headquarters and result in a broad but sound directive to the commanders involved. Based on this directive, each lower echelon of command develops its plan to include all information, and the decisions, necessary to permit the subordinate Air and Ground Commanders to accomplish their respective tasks. The evaluation of the Air-Ground plan is based upon the principle of mutual accord between Air and Ground Commanders. Differences of opinion are effectively brought into the open and mutually resolved, and experience has shown that it is a rare case indeed which must be carried to the top command for final resolution. However, should this be necessary the means of doing so exist, and in no case can there be a case of "no decision". At the lowest echelon, the selection of targets and the allocation of effort applied to air superiority, interdiction and close support, depends on the concurrence of both the Air and the Ground Commander.

Operational planning is mainly conducted at the FIELD ARMY—TACTICAL AIR FORCE level, however the plan for the

use of the Tactical Bomber support and its escort, and the allocation of forces to the various Tactical Air Forces is conducted at the TACTICAL AIR COMMAND—ARMY GROUP level. Conferences provide the most efficient method of planning Air-Ground operations. These conferences usually consist of meetings of the Air and Ground Commanders and selected members of their staffs. Operations and Intelligence personnel are particularly important here. At these conferences both sides inform the other of their respective plans, capabilities and requirements. A typical agenda for such a joint conference would include a review of the current battle situation, a weather forecast, a summary of directives from higher authority, and a description of the current Army and Air Force plan of action. Based on a conference of this nature, detailed instructions are issued to the lower units. These instructions must include specific tasks for each air unit and detailed instructions as to how coordination with specified Army units is to be achieved.

I will now cover some of the capabilities and limitations of Tactical Air Power which high-level staff officers and commanders should recognize and bear in mind when planning or executing offensive Air Support Operations.

There are several types of factors which affect the degree of air support that we are able to deliver. There are those technical capabilities and limitations which are inherent in aircraft, such as, the built-in speed, range, and maneuverability of the airplane. It is unnecessary to discuss specific current airplane characteristics here, since aircraft characteristics are subject to continuous change. It is necessary to mention, however, that when it comes to designing aircraft for ground support, all the characteristics must be carefully weighed against each other.

Strategic factors must also be considered. These factors

will affect the amount of air support which will become available. The strategic concept, or the manner in which a war will be waged has a great effect on the number of Tactical Air Forces and Air Support Combat units which will be included in the organization of our country's Air Force. It will also effect the rate of mobilization and training of such units as will be required. It affects the priorities for type aircraft which will be produced.

Then finally we have the operational factors which affect the availability and effectiveness of air support. The principal operational factors are: the mission and method of operation of the supported unit, climate and weather, the terrain, and the number, size and condition of the available airfields and their distance from the front lines. All these factors have a great bearing on the efficiency of an air unit and consequently effect the final availability of air support to the surface force.

Now I should like to discuss new developments in aircraft and electronics as pertain to tactical air requirements. Generally speaking, technical developments, which affect Tactical Air Operations, are progressing in a satisfactory and encouraging manner, and I will mention some of the more important developments.

Much consideration and study has been devoted to determining the advisability or inadvisability of developing specialized types of aircraft to perform specific tactical missions. No one airplane has yet been developed which will completely satisfy *all* requirements. Different types of aircraft complicate logistics and training, are expensive, and reduce the air commander's capability in application of mass attacks. In short, flexibility is destroyed. However, there is one common denominator which we believe all aircraft used in tactical air support operations must possess—that is the ability to live in the air under intense enemy ground and air opposition.

In the field of combat type aircraft, our future fighter-bombers, through the use of more efficient and more powerful jet engines, and through improved aircraft design, will be capable of carrying heavier armament loads and will be capable of greater endurance. In this connection we must remember that the jet aircraft is only in the infancy of its development. In the Korean situation the jet aircraft has proved itself a formidable weapon. Combat experience has proved that the F-80 fighter will take more punishment from either air or ground fire than piston engine fighters. This contrasts with previous fears that the delicately balanced gas turbine engines might be more easily put out of action. Jet aircraft can now match piston engine planes in range and capacity to carry bombs, rockets and guns, while far exceeding them in speed and rate of climb. Jets are also easier to maintain. The pilots "feel better" in jets. They found that jets can take it better than conventional types, and they can get out of hot spots in a hurry or go upstairs and fight if attacked. On a broad basis, the Korean situation consolidated previous views—we know we have to have a plane that can fight its way through enemy air opposition and also do ground support work.

Beyond the fundamentals of jet fighter operations, the Air Force didn't learn a great deal in South Korea because the one jet type in service there was not especially designed for ground support work and there were so few enemy jets in the air.

Small units of other jet fighters and bombers, both designed for ground support, are expected to see combat in North Korea. Undoubtedly the North Korean phase will see some changes in operations because of the tremendous advantage of air bases near the battle line. The F-51 Mustang propeller fighter extensively employed in Korea could not have been used if the North Koreans had employed a sizeable force of jets.

What about the future of the Air Force in view of Korean experience and the newly available funds for building up to the "70-Group" idea?

Under the former limited funds program, the Air Force could not do all its planners felt should be done, so it concentrated on defense and strategic air problems that would have to be met first in a major war. The Army ground forces, under similar money restraints, did not have enough divisions to justify more emphasis on tactical air strength than was given it.

Now that is changed. There will be ground forces to support and funds for development and funds to build and train an Air Force for the job. New purchase orders will call for nearly doubling the ratio of air defense and ground support planes to medium and heavy bombers.

Without going into detail I wish to mention three fundamental criteria of tactical aircraft to accomplish the tactical mission. They are:

a. The ability to live in the air.

b. Provision for delivery of effective armament.

c. Possession of effective radius of action.

With these three basic requirements in mind, let us turn to an examination of the aircraft we now have in light of their capabilities and limitations.

An example of a present-day tactical fighter aircraft is the F-84E. Its speed of over 600 mph is considered satisfactory for present day air-to-air operations. Climb to 30,000 feet in 10 minutes is unsatisfactory for intercept purposes. Endurance of nearly 4 and ½ hours (only available when carrying 4 tanks)

appears to be good; however, these estimates are obtained at high altitude with maximum fuel and air-to-air armament. The F-84E airplane is committed to day operations, in that it is not equipped with night and all-weather navigational, intercept or bombing systems.

In the tactical bomber field we have the North American B-45 Tornado. Its speed of well over 500 mph is acceptable today for survival purposes during night and all-weather operations, but marginal during daylight operations. This estimate is based upon intercept probabilities. The gross weight of the B-45 is excessive for operation from hastily prepared airstrips but its radius of action should eliminate the necessity for its use of such airstrips. The take-off ground run distance of 3,700 feet at gross weight condition is at sea level under standard day condition from hard surface airstrips. Its bomb loads are considered satisfactory for present and foreseeable future requirements. The B-45 is the only all-weather airplane presently available to tactical air units. It is equipped with an electronic navigational and bombing system.

The ground support aircraft to replace the F-84E will be the swept wing F-84F manufactured by the same firm—Republic. This aircraft is faster and has a better rate of climb than its predecessor. Its various radii of action as pronounced by the manufacture for the different armament loads are acceptable. It appears that the F-84F possesses the dual capabilities for both tactical air support and air interception. This aircraft will be ready for mass production in the near future.

The aircraft which appears most capable of accomplishing the over-all tactical fighter mission is the air support version of the Lockheed F-94C. The aircraft was primarily designed for all-weather interceptor operation but lends itself readily to modifica-

tion for the air support mission and tactical reconnaissance. In general, the aircraft incorporates all the favorable features of the F-80 but has nearly twice the power, a strong thinner wing for higher speeds and loads, greater combat radius, and added provisions for carrying external ordnance loads. A unique feature of this aircraft is its dual speed brakes, a combination of those used on the standard F-80 and F-86. It has, on occasion, descended from 40,000 feet, landed and parked on the ramp in 2½ minutes. In a sustained vertical dive these speed brakes hold the aircraft to a maximum of Mach. 7. Tactical Air Command has requested higher authority for the procurement of this aircraft which will be available in the near future.

The need for an aircraft capable of delivering armament on selected targets under all-weather conditions and during hours of darkness dictates a requirement for the tactical bomber. The present bulk and weight of electronic bombing and navigational systems preclude the use of a fighter type for this mission. Furthermore, there are certain targets and conditions where a heavy, concentrated weight of bombs is more effective than that capable of delivery by fighter-bomber attacks.

At present the Martin B-51, North American AJ-1, and British Canberra are being evaluated. The B-51 is capable of remarkable speed. The British Canberra is very fast and maneuverable and possesses an exceptional combat radius under certain conditions.

Today there is a tactical deficiency in adequate navigational and bombing systems. Fighter-bombers will be useless during darkness and bad weather until a miniature navigational system is available and electronic air-to-ground ranging is perfected. Systems presently being developed fall into two categories:

a. Those which employ ground stations (predetermination

of target coordinates limited to static situations over well-mapped territory) such a light weight Shoran; ground stations and beacons.

b. Those which are completely airborne.

The perfection of completely airborne electronic bombing and navigational systems holds the greatest promise for all-weather tactical air operations. What is required is an electronic replacement for the pilot's eyes so that close tactical support can be undertaken under any weather conditions.

Another development is in ranging radar equipment for the A-1 gun sight. This can be used to determine range in attacks on ground targets as well as air targets, resulting in increased accuracy for strafing and rocketry attacks. This system, or similar development, will be a big step forward in providing the single-seat fighter with all-weather air-to-ground capabilities.

At the present time our control system is equipped for the most part with mobilized versions of static radar equipment which were developed during the closing phases of the last war. The height finders and the medium range search radars had many deficiencies that have become increasingly more apparent as techniques and aircraft change. Some of the major deficiencies are:

a. Lack of suitable range.

b. Easily jammed by Electronic Counter Measures activities.

c. Lack of flexibility (each function of the control system requires a specialized piece of equipment, i. e., detection, location, and control).

Planned improvements are:

a. The modification of the height finder equipment to increase its range.

b. Medium range search radars are to be modernized by the addition of a Moving Target Indicator kit. This modification will eliminate ground clutter from the scopes and will permit only actual air targets to be shown. The next step for this piece of equipment will be to replace it with a completely mobile version for air warning and control of tactical air operations.

The communications equipment now used for the transmission of air-to-ground and air-to-air intelligence is becoming obsolescent because of its slowness and vulnerability to Electronic Counter Measures.

Our aim is to obtain an integrated control and communication system sufficiently light-weight, mobile and capable of fulfilling the requirements. These are:

a. Detection of airborne and surface objects (without beacon).

b. Identification of detected objects.

c. Location of detected objects.

d. Control of friendly aircraft and missiles.

e. Continuous air-to-ground, air-to-air and ground-to-air communications.

Until the beginning of August the standard rocket armament was the 5″ HVAR. This rocket was only effective when hits were registered on the tracks or the rear of the tank. They were ineffective against the heavy armor on the front and only

moderately effective on the turret. However, a 6½" ATAR rocket, with a "shaped charge" warhead on a 5" motor has been tried with great success. These will penetrate 16" of armor steel. (Joseph Stalin Mark III carries 11" of armor plate.) Incidentally, napalm, when dropped from altitudes below 100 feet, has proved to be most effective against tanks and troop concentrations.

A new but very interesting development just getting underway is the convertiplane. A convertiplane may be defined as a vertical rising aircraft having conventional aircraft forward speed capabilities. The second phase of this program will be to build a light cargo convertiplane.

In the field of airborne-troop carrier operations the U. S. Air Force has under development three (3) types of aircraft that are expected to add versatility to this type of operation. We have under development, and now flying, the C-124 which has been called a global troop carrier aircraft. It is capable of carrying a fifty thousand pound pay-load or two hundred personnel. This aircraft is designed for the rapid loading and unloading of all types of heavy military equipment with the exception of our largest tanks.

We have under development several assault type transports. These aircraft are designed to land troops and especially heavy military equipment into small unprepared airfields. Assault type transports in general are designed to carry out the functions performed by gliders during the past war in a more rapid and efficient manner.

Many aircraft manufacturers are presently making engineering design studies to determine the feasibility of development of pod carrier aircraft. These design studies apply to both conventional aircraft and to the helicopter. The purpose of this type aircraft is the rapid re-supply of an airhead or other activity by air-

craft capable of lifting a pre-loaded pod or carrier unit from a rear base into a forward base. As a matter of fact, Hughes Aircraft Company is now ground testing their XH-17 Flying Crane, which is a helicopter powered with two J-35 engines, which are normally rated at 5,000 pound thrust, driving a 136 foot rotor. This aircraft is designed to meet an Army need for short haul of heavy equipment such as tanks or artillery across terrain hitherto impassible.

All these developments clearly indicate that much thought and energy is being devoted to the technical aspects of the development of tactical air. There is no indication that the subject of Tactical Air Support is being allowed to stagnate in either the technical, tactical or theoretic fields.

Now in closing, I wish to touch on one more subject, which is of great interest to me and which I am sure will interest this audience. I refer, of course, to the tactical employment of Atomic Weapons. On this subject I can only apply a little deductive reasoning. We are all aware that the stockpile of A-bombs is increasing rather than diminishing. As this stockpile of available weapons increases, more and more consideration is being given to diversified employment; that is, to uses in addition to the primary strategic use. I do not pretend to know what our present stockpile of these weapons is, but I do know that the problem of tactical employment of this weapon is receiving much serious attention by many people whose business it is to consider these matters. I consider it self-evident atomic weapons will be an accepted part of tactical air operations in the near future and that they will have a profound effect on the conduct of both land and sea warfare. It may be that we will never have enough of these weapons to permit us to be prodigal in their use, but you may be assured that when the objective is important enough, these weapons will be used.

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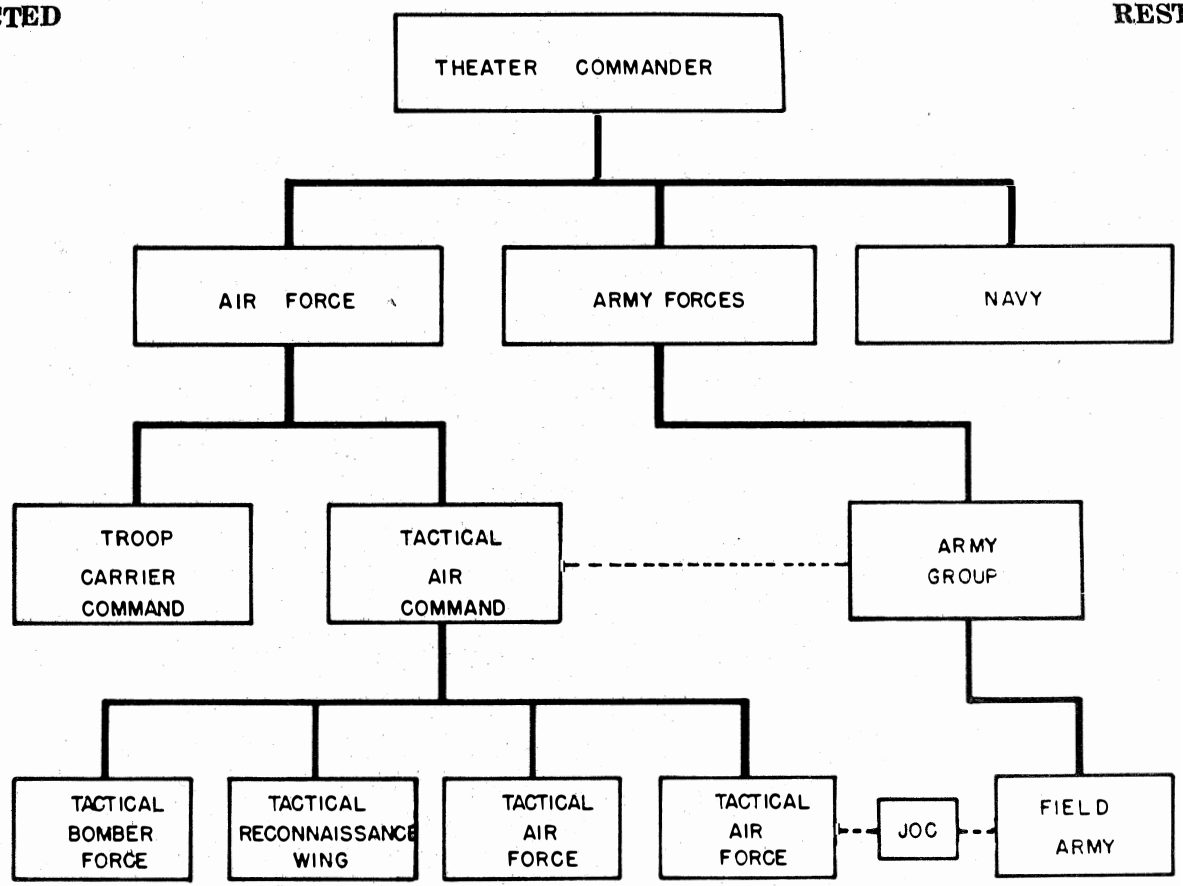
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TACTICAL RECONNAISSANCE WING
TACTICAL AIR FORCE
TACTICAL AIR FORCE
JOC
FIELD ARMY

MAJOR LOGISTICS LESSONS OF WORLD WAR II

A Lecture delivered by
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at the Naval War College
on 7 November 1950

Time brings the truth to light.
(Greek proverb)

The subject of this paper is "Major Logistics Lessons of World War II," or—"Enough was Too Much." I think it would be better if we called it "Some Major Logistics Lessons of World War II," because we can't go into all of them here, and therefore I have selected a few that I feel are among the most important. Actually, nearly everybody has his own ideas on a subject like this one. And that's perfectly natural—all I can do here is to give you a sort of kick-off, to give you some ideas which you can think about, discard, or add to, in accordance with your own convictions. The main point is to get our thoughts focused on the logistic aspect of war. You know, if we take Webster's word for it that a lesson is something that is "learned," I sometimes wonder if we should talk about lessons at all.

Now—looking at the title again, it is easy to see that in order to condense this sort of discussion into an article of this size we will have to put some artificial limitations on the area we cover. Now, as I see it, we should take the most important things first, and I would say that lessons on an international and national scale would, generally speaking, be the most important. Next, we have the overall military problems, and then the individual military departments. After that we have the theater problems and finally the operating forces themselves. Now, since we can't cover all these areas completely, I decided to do it something like this:

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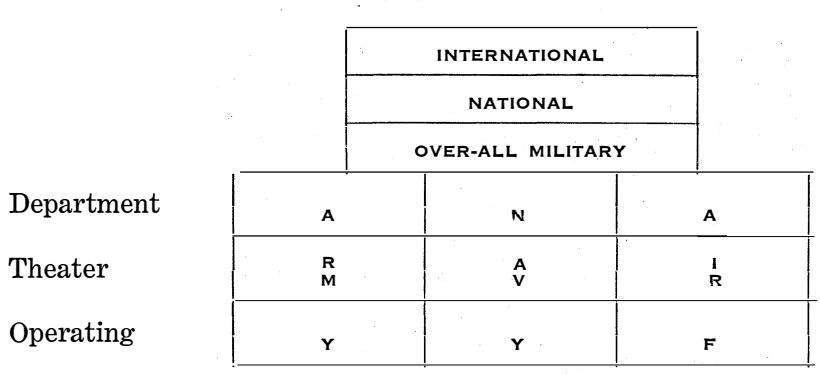

This illustrates graphically the entire area of logistics application, from international, at the top, to operating forces, at the bottom. Now, as I said, I feel we should cover the top three divisions as fully as we can—that is—the international, national, and over-all military. Then as we drop to the single service levels, and on down, I think it appropriate to concentrate on the naval aspects. Of course, at the theater level, because of the unified nature of the command, it is difficult to divorce one service from the others.

In addition to considering the areas where we may find logistics lessons, let's stop for a minute and see what kind of logistic lessons we might uncover. Of course, I could just recite as many lessons as we have space for, but I think it will help in approaching the problem if we can group the lessons into general categories. Probably there are several such categories we could use, but, to me, there were three that seemed the most logical.

First, and possibly most important, lesson in *PRINCIPLE.*

Lessons learned in principle would be reflected in *ORGANIZATION.*

And last, as they say, but not least, we had our lessons in *OPERATION.*

Now, if we think of the areas of logistics application, and of the three broad categories into which logistic lessons might fall, it may help us to understand a little better the significance of these lessons. This is intended simply as a sort of an orientation aid, and I will not attempt to pin-point each lesson into an area or category. Actually, by their nature, these lessons must overlap each other.

It has been said by many well qualified people that World War II was a war of logistics. It was characterized by the totality with which manpower and resources were mobilized and by the energy with which the two sides attempted to destroy each other's material resources for war. If we recall the bombing campaigns of both the Axis and the Allies, if we remember the desperate battle of the Atlantic sea lanes and the enormous magnitude of lend-lease shipments, we realize the part that materiel played in the world's greatest war.

Now, as we know, all wars have not followed this pattern. Of course, every war has presented its own problems of equipment and supply. But the crudeness of weapons and equipment, the relatively undeveloped industrial systems, and the slow and inefficient means of transportation for a long time restricted warfare to a relatively limited basis. As weapons have become more destructive, as industry has developed, and as transportation has become more rapid, the tempo and the extent of wars have risen until now it is common to speak in terms of total war.

About this time of year a number of our students are wrestling with the comparison of war potentials. When you try to make such a comparison you become aware rather quickly of the number and complexity of the factors involved in a present day war effort.

This was recognized by our top man in the last war and is illustrated by some of his own words. This is a quotation:

> "The war in Europe has reached the final decisive phase—the attack on Germany itself. But we have much longer and much farther to go in the war against Japan.
>
> "All these operations had to be planned far in advance —and that does not mean merely drawing arrows on maps. It has meant planning in terms of precisely how many men will be needed, and how many ships—warships, cargo ships, landing craft—how many bombers and how many fighter planes—and how much equipment and what types of equipment down to the last cartridge. And it has meant getting all of them to the right place at the right moment.
>
> "It has meant establishing for our Army and Navy supply lines extending over 56,000 miles—more than twice the circumference of this earth."

The man who spoke those words was the late Franklin D. Roosevelt, speaking in 1944.

If there is any single logistic lesson that can be drawn from World War II, I think it must be this.

NATIONAL LOGISTIC STRENGTH HAS A CONTROLLING IMPORTANCE AS A MAJOR FACTOR IN NATIONAL WAR POTENTIAL.

I believe that in any major war between world powers, the victor must have substantial and sustained superiority in the quality and quantity of its weapons and supporting equipment. To have this superiority it must have, or have access to, a preponderance of national logistic strength—that is, the resources, the manpower, the

production facilities plus the transportation to direct this power against the enemy.

You know, in contests of any kind, we usually learn most of the lessons from the losers. After the Nurnberg executions, one of the few persons left alive, who had served on the Armed Forces High Command (the OKW), was General Walter Warlimont, who had been on that assignment six years and was General Jodl's deputy. In a document he prepared after the war he had this to say:

> "In any event, one fact has definitely been established by Germany's experience in World War II: Even though daring plans in the fields of strategy and operations, exemplary military performances, and several other imponderables may offer favorable prospects to the weaker party during the course of hostilities, the *entire war potential* of a nation is in our time the *decisive factor* in a life-and-death struggle among peoples. This potential is composed of quantities which must be computed with mathematical precision.
>
> "The demands which Hitler's conduct of the war made upon the German people exceeded the limits of their capabilities in every respect."

Now, with national logistic strength assuming such a dominant role in our war potential, it becomes essential that we be able to harness this strength with a swiftness comparable to the speed of purely military mobilization. I realize that, with anything as complex as our industrial and economic system, this can never be easy or foolproof. Even so, it certainly seems obvious that we should work out a system of national mobilization now so that at least the system will be set up in plan form ready to be executed, not devised, when war comes.

Let's look for a moment at what happened in World War II. In the early thirties, plans were begun which were intended to provide the formula for economic mobilization. There were several revisions, but in 1940, a plan was on the books which was supposed to be triggered by a mythical M-Day. This plan, as such, was never used. Various reasons have been given; some say that Roosevelt was reluctant to allow any person other than himself to assume the powers that would accrue to the administrator of the plan, while others point out that because of the piecemeal manner in which he became involved in the war, the M-Day which was to trigger the plan never occurred.

In any event, what actually happened was the trial and error development of a scheme to effect the diversion to war of an industry which is traditionally governed by the law of supply and demand. Agency after agency was set up, and many of these were designed just to correct the shortcomings of their predecessors. The resulting network of alphabetical agencies consisted in a large degree of collections of confused and ineffective transplanted dollar-a-year men. I've picked out a number of these agencies and listed them here. Remember, though, that this is not all of them by any means.

SPAB—Supply Priorities and Allocations Board
OPM—Office of Production Management
OPACS—Office of Price Administration and Civilian Supply
OEC—Office of Export Control
EDB—Economic Defense Board
DDAR—Division of Defense Aid Reports
OLLA—Office of Lend-Lease Administration
OCD—Officer of Civilian Defense
OFF—Office of Facts and Figures

These were some of the pre-Pearl Harbor agencies. And here are some of the better known ones that came later after Pearl Harbor:

WPB—War Production Board
OPA—Office of Price Administration
WMC—War Manpower Commission
NWLB—National War Labor Board
ODT—Office of Defense Transportation
WSA—War Shipping Administration
NHA—National Housing Agency

I think this may be a good time to state our second lesson.

WE MUST HAVE A PLAN FOR SWIFT NATIONAL MOBILIZATION, CONSISTENT WITH OUR ECONOMIC AND POLITICAL SYSTEM.

Notice, please, that I have used the words "consistent with our economic and political system". I feel that we must always keep in mind the delicate balance of the system under which we prefer to operate. There are so many economic forces involved in this system that any plan we use must take into account the possibility of creating dangerous local disruptions and hardships.

But even more important is the problem of politics in a democracy. No one can predict the temper of a future Congress. And Congress is always reluctant to commit its successors to broad governmental blueprints. However, I personally feel that this problem of national mobilization must be met the same way that we meet the problem of military mobilization. And I think that industry wants it met that way. When I was a contracting officer in Washington a little over a year ago I had any number of business people come in and ask what their part in a mobilization would be. Other

contracting officers had the same experience. And, remember, these firms were not looking for current business; they were plenty busy with current orders. They just wanted to know what their part in mobilization would be so that they could avoid the confusion of the last war.

Now, I'm certainly not in any position to say whether we are slipping back into the piecemeal approach we had in the last war. I'm not sure any one is. But at least we do have the NSRB and the Munitions Board working away at the problem in two important areas. I think they are ahead of where we were in 1940, if only because of our World War II experience. Unfortunately, I'm afraid the perennial Washington Battle of Bailiwicks is taking its toll of speed and efficiency.

You know, not too long ago a knowledge of logistics was not considered to be of any particular advantage to officers generally. In fact, the tendency was illustrated right here at the War College. In 1926, Captain R. R. Backenhus succeeded in setting up a logistics section here, and started a system of committee projects in which naval campaigns were analyzed logistically. However, the succeeding head of the logistics section said that such matters as shoveling coal and combat loading didn't belong with the study of the principles of war, so they abolished the section and abandoned the study of logistics—for about twenty years.

Unfortunately there has always been a natural tendency on the part of people who have to make plans to figure out some strategy and then assume that there would be enough logistic support. This worked all right when there was more support available than the military needed or could use. But as we all know, the size of the last war caused us to realize that somebody had to be planning the logistics as well as the strategy, because the logistics often got to be the limiting factor. Unfortunately, because it had never been

too important, there were almost no officers who fully understood the problems of logistics. That didn't make the problems any less real, and officers who were put in positions of logistic responsibility just had to learn the hard way. Because these positions were gradually recognized as key billets, the services began to realize that we must have high calibre officers who had more than a passing knowledge of logistics.

Recently, I asked Admiral Carney for his idea of what points I should cover in this talk. He placed great emphasis on the fact that we started the war almost entirely *tactical-minded* and had to learn to be *logistics-minded.* And he said that as DCNO for Logistics, he had had no more important project than the creation of an educational system in the Navy concerning logistics.

I think this points up the third major lesson.

WE HAVE RECOGNIZED LOGISTICS AS A MILITARY SCIENCE, AND, ADDITIONALLY, THE NECESSITY FOR THE TRAINING OF HIGH CALIBER OFFICERS IN LOGISTICS.

I think this principle has been recognized now by all the services. Logistics courses are incorporated in the curricula of all of the service Colleges and, in addition, the Industrial College of the Armed Forces devotes its whole course to the producer phase of logistics. Also, more top-rated officers are now occupying billets which are essentially logistic in nature—as for example, the G-4, Air Force Materiel, CNO Logistics, Munitions Board, and NSRB.

In 1945, Mr. Ferdinand Eberstadt was detailed to make a report and recommendations in regard to the structure of the armed forces. This study was used in Congressional discussions on unification. One of the conclusions in the report reads in part like this:

"It is believed that logistic planning of the scope re-

quired by this last war must be recognized as a military science in itself, a sine qua non to success in strategy and tactics."

Well, now I've talked about the part logistics plays in the national picture, how industry must be tied in, and how logistics has developed as a military science. This gets us down to the point of military planning—I use "military" to mean all of the armed forces—and, in particular, the relationship between strategic and logistic planning. To get a better picture of this, I think we might look back to the early days of the war.

The way the Japanese pulled their Pacific fait accompli in 1941 put us just posterior to a large black logistics eight-ball. Everybody needed supplies and there weren't enough for anybody. As Admiral King said to the Secretary in 1942: "it was evident that no matter how much material of all types was produced in 1942, it would not be enough." Naturally, each service felt justified in trying to procure as much for its own purposes as possible. The Eberstadt Report points out that if it had not been for the fat that existed in our economy at the time, this sort of willy-nilly procurement could have led us to disaster. Now, in the meantime, the Joint Chiefs of Staff, who had held their first meeting in February of 1942, were beginning to fashion our over-all strategy. The strategic plans of the J. C. S. assigned tasks to the services and established, in broad terms, the numbers and types of military units required. Then they got out strategic concept papers, preliminary campaign studies, and strategic deployment summaries. That's quite a bundle of papers. But those concept papers and campaign studies were very general in nature and they weren't official, only informational—so they weren't much use in logistic planning. And the deployment summaries were at first prepared by the individual services, based on availability of forces, not

requirements. In other words they would say: "Because we have 100,000 men available, we will deploy them in X overseas theater." This did not consider whether they could be supported in that theater. Well, you can see that this sort of procedure put logistic planning on a dangerously inexact basis.

Now, after 1943, a lot of this difficulty was eliminated by the work of the Joint Logistic Committee—part of the J. C. S. organization. Admiral Badger told us about some of the things they did. Even so, as late as 1945, there was an interesting example of what not to do that illustrates what I am driving at. Now, these things happened in all the services and this is just an example that seemed to be appropriate. The Army Air Force decided to deploy certain types of planes in the Pacific, and scheduled production accordingly. But the joint logistic planners found that existing airfields in the Pacific, plus those in base development plans, could not accommodate the airplanes. The result was that planes and parts that could not be used had been produced at the expense of other needed items.

The lesson I am trying to illustrate is this:

CONCURRENT STRATEGIC AND LOGISTIC PLANNING IS ESSENTIAL, AND AS A COROLLARY—WE MUST HAVE LOGISTIC ORGANIZATIONS AND PROCEDURES WHICH WILL MAKE POSSIBLE EFFECTIVE COORDINATION OF OPERATIONAL AND LOGISTIC PLANNING.

That's a mouthful, and probably you've heard it stated before. It may even sound elementary, but some things that seem elementary, after you know about them are not so obvious beforehand. For instance, although you wouldn't believe it, it is a fact that even under wartime conditions the Director of the Logistic Plans Division in CNO was not given access to the "Top-Secret" dispatch board of

the Commander-in-Chief until late in 1943, two years after the war began.

Today, as you know, the situation is considerably different. We now have well-established logistic organizations in the form of the Munitions Board, G-4, Air Materiel, and DCNO Logistics, and these are integrated into the military command structure. And we have officers in these positions who have earned the confidence and respect of their own and the other services. When strategic plans are made nowadays, they are made with the advice and concurrence of astute people whose primary duty is to keep a running estimate of our national logistic capability.

Now I'd like to turn to a little different field: that of Atomic Energy.

The power of the atomic bomb is well known to all of us. Now, not many people maintain that this weapon was responsible to a very large degree for the winning of the war. On the other hand, though, think what might have happened if the Axis had perfected this thing first!

We have all heard that there were some efforts made by Germany in the field of nuclear research. Their efforts however were nothing compared with our enormous projects, but there is sufficient evidence to show that the German scientists were on the right track.

In 1942, the leading German physicists held a meeting at which possible military application of atomic energy was discussed. They invited the Nazi military leaders to attend this meeting. General Keitel's answer to that invitation said essentially this:

"You will understand, of course, that I am too busy at the moment and therefore have to decline." In other words, a polite brushoff. And Himler wrote that unfortunately he would be out of

town the day of the meeting. Admiral Roeder also regretted. I think we owe a debt of gratitude to the myopic vision of German officialdom in regard to this particular investigation.

I think this serves as an illustration of our next major lesson. And I feel that it has strong logistic implications because it has to do with the means of waging war.

THE LESSON IS THAT THE IMPORTANCE OF SCIENTIFIC RESEARCH IS CONTINUALLY INCREASING.

The United States recognized this in the establishment of the Office of Scientific Research and Development in the last war. Of course, scientists are not generally military-minded, and at first there was a gap between the services and the scientists. But as officers learned how to use the laboratories and as scientists were sent right into the combat zones to learn what the problems were, this gap was broken down. This was a rather slow process, but fortunately in World War II we could afford the luxury of slowness. I don't think many people feel that we can afford this luxury in another major war.

Now, you can't assign somebody to make a discovery, any more than the Patent Office could answer the veteran who wrote in and asked for a list of "all the uninvented inventions". No one can be sure where the next discovery will appear. So you need to have a means of keeping in touch with science as a whole. And, also, of course, you have to set up projects in fields where there appears to be military application.

When the Office of Scientific Research and Development was disestablished, the services began to set up their own formal organizations to foster research. The Navy, benefiting by the vision of Vice Admiral Harold Bowen, took the lead and, in 1946, set up

the Office of Naval Research. And, shortly afterward, as you know, the Research and Development Board, which operates at the J. C. S. level, began to take shape.

Because of these organizations, plus other service offices now devoted to research, the military is becoming more closely associated with scientific research. With the Russians making the progress that they are, I think you'll agree that we can hardly afford to forget this lesson.

Now to change the subject again. Recently I was looking through a wartime list of Naval Bases overseas and noticed some very interesting facts. For instance, in 1944 we had approximately 620 bases overseas, and note that this figure excludes any purely Army or Air bases. That's quite a few bases, and when you think how much even a small base costs in terms of material, manpower and the inescapable overhead, 620 bases represents a very substantial drain on our resources. Now, I'm not in any sense intending to convey the idea that these bases weren't useful. We all know that they were very useful. And in many cases they were the only thing that saved the day.

But I came across some other very interesting facts in that list of Bases. There were 158 bases either disestablished or abanddoned before VJ-Day. There were a good many others on which the date wasn't given, and probably at least part of these too were disestablished or moved before the end of the war. Now every time a base is moved or rolled up, it takes a lot of labor and a lot of shipping space to get it somewhere else. And of course it takes more labor to unload it and set it up in a new location. And it takes time, quite a bit of time. So when we talk about moving or rolling up one-fourth of all our bases, we are talking about an operation of considerable size in itself. Of course, any bases we had to abandon are just that much material thrown away.

Maybe I'd better stop wandering and tell you what I'm leading up to. What I've just been saying was intended to give you an idea of what our tremendous network of bases cost us in the last war. I feel that a good part of the support that these bases rendered to the operating forces could have been given just as well by *floating* bases. Those of you who are familiar with Commodore Carter's Servon 10 or our own Admiral Beary's Logistic Support Force know what these outfits can do. The floating bases can service fleet units in port and the mobile support forces can keep the combat units right in the battle area for weeks at a time if necessary. I think we can draw a very important lesson from all this.

WE MUST AVOID UNNECESSARY BASES AND CONSTRUCTIONS, ESPECIALLY THROUGH THE USE OF FLOATING SUPPORT FOR THE OPERATING FORCES.

I would like to point out again that I am not intending to detract from the importance of keeping up our development of advance base techniques. For certain purposes they are irreplaceable. For instance, we can't very well build a floating airfield, even though some people would like to. And there are many other cases where you just can't use a floating base—as for example where there isn't sufficient harbor. But I believe that the idea of floating support is something we can all think about with profit. It's a coming thing. It's usually cheaper, it can move or disperse to avoid atomic attacks, and you can have it where you need it without having to bargain for shipping space. Admiral Low told me recently that Admiral Sherman is strongly behind this idea. So, you might say that, unlike so many things for which there is no other reason, it is policy too.

Well, that's six lessons. There are many more I could give,

but I will limit this discussion to one more. There are so many that seem deserving of mention. For instance, there is the problem of packaging and marking (a lesson I'm not sure we learned); there is air transportation; there are the new engineering techniques like the artificial harbors and floating docks. These are all important lessons. And there is another one that I think we might bring up as a particular subject for further study. That is the question of shipping control. We learned something about land traffic control in the first World War, but the more extensive second war forced us to do something about getting the most out of our ocean shipping. This is a particularly difficult problem to solve.

But there was one lesson that had its roots right in the firing line and yet had implications clear up to the national level. I'll have to explain this a little bit with some examples.

In planning an individual operation, one of the things the commander has to figure out is his requirements for all of the items to be used in the operation. He does this essentially by multiplying the forces involved by various usage factors and then multiplying the result by his own judgment factor. If he has good usage data and knows the conditions under which it was gathered, he will rely on it. Then his judgment factor adds in his own knowledge of this particular operation. But if he doesn't understand the usage data, or doesn't trust it, then he is forced to make his judgment factor more of a wild guess or a maybe pious hope. The equation: (Forces x Usage Factors) J. F. = Requirements is perhaps oversimplified, but generally speaking, the requirements equal the forces times the usage factor, times the judgment factor; and if the usage factor is good, the result can be fairly good. But look what happens if we have *unreliable* usage factors:

(Forces x ?) ? = ?

The commander's J factor becomes another question mark and the result is often fairly horrible. Most of you can probably remember seeing somewhere in your travels the visible results of this sort of situation in the form of huge piles of rusting or rotting equipment.

I think we can draw another significant lesson from this.

IT IS ESSENTIAL THAT WE COLLECT AND TABULATE GOOD USAGE DATA THAT INCORPORATES THE OPERATING EXPERIENCE UNDER WHICH IT IS ACCUMULATED.

Now what I've said was intended to show how this busines of usage data can affect individual operations. But it has much more important implications. For instance, think of the part that it plays in determining storage levels at points along the pipe line to the front. Storage space is almost always at a premium in wartime. And at even more of a premium is transportation. If we have to store or ship too much of one thing it means sacrificing something else that actually may be needed worse.

Finally, this problem extends up to the Munitions Board, and the NSRB, and even back to industry itself. Lately, you know, there have been some remarkable development in the field of rapid electronic computation, and there have been efforts to apply these computers to the logistic field, on a national level. The trouble always is that if you don't know what to put in one of these gadgets, you are up against the quickest means of making mistakes yet devised.

Looking at the national picture, this usage data really gets to be a problem. You know, quite a few logisticians have made a

name for themselves by always having more on hand than was needed. This may get good fitness reports, but I submit that with every resource of the nation strained as it would be, too many outstanding logisticians of this variety might well lose our next war for us. We have to know what we need, so that we are able to make enough of everything. I don't think we can afford to make too many gross errors in production as we had last time.

Just as a final example of what I mean—in the last war we manufactured 21 million tons of ammunition. Half of that got overseas. Four million tons, or less than a fourth of it was shot at the enemy. Now, I certainly don't advocate trying to shoot the last man with the last bullet, but 17 million tons extra does seem to be a little too much.

Now, as a summary, I would like to restate these seven lessons in condensed form.

1. NATIONAL LOGISTIC STRENGTH HAS A CONTROLLING IMPORTANCE AS A MAJOR FACTOR IN NATIONAL WAR POTENTIAL.

2. WE MUST HAVE A PLAN FOR SWIFT NATIONAL MOBILIZATION, CONSISTENT WITH OUR ECONOMIC AND POLITICAL SYSTEM.

3. WE HAVE RECOGNIZED LOGISTICS AS A MILITARY SCIENCE.

4. CONCURRENT STRATEGIC AND LOGISTIC PLANNING IS ESSENTIAL.

5. THE IMPORTANCE OF SCIENTIFIC RESEARCH IS CONTINUALLY INCREASING.

6. WE MUST AVOID *UNNECESSARY* BASES AND CONSTRUCTIONS, ESPECIALLY THROUGH THE USE OF FLOATING SUPPORT.

7. IT IS ESSENTIAL THAT WE COLLECT AND TABULATE *GOOD* USAGE DATA THAT INCORPORATES THE OPERATING EXPERIENCE UNDER WHICH IT IS ACCUMULATED.

RECOMMENDED READING

This section lists material published in current periodicals which will be of interest and value to officers of the Navy, Marine Corps, and Coast Guard.

"United States Military Policy."
By Blair Bolles. Foreign Policy Report. December 15.

"The New Weapons Company in Korea."
By Captain James F. McInteer, Jr. USMC. Marine Corps Gazette. January.

"Between Limited and Total War."
By Raymond Aron. The New Leader. January 8.

"China's True Foes."
By Theodore H. White. The Reporter. January 23.

"New Approaches to World Peace."
By General J. Lawton Collins. Combat Forces Journal. January.

"The Russians Don't Hear."
By Alex Inkeles. The Atlantic. January.

"India on the Fence."
By Kusum Nair. Fortune. January.

"Japan and the Crisis in Asia."
By Shigeru Yoshida. Foreign Affairs. January.

"Europe's Northernmost Frontier."
By John J. Teal, Jr. Foreign Affairs. January.

"The Mumble in the Voice of America."
By William H. Wells. Harper's. January.

"If Russia Strikes in Europe."
By Roy Cross and William Green. Aero Digest. December.

"The Case For and Against Europe."
By Jean-Jacques Schrieber. The Reporter. December.